Medical Science

Knowledge, attitude and practice of influenza vaccination among type 1 and type 2 diabetes patients in King Khalid University Hospital (KKUH) Riyadh, Saudi Arabia

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DISCOVERY
SCIENTIFIC SOCIETY

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ABSTRACT

Aim: This study aimed at investigating the knowledge, attitudes and practices of influenza vaccination among diabetic patients attending diabetic outpatient clinics in King Khalid University Hospital (KKUH). *Method:* A cross-sectional survey was conducted through a conveniently selected sample consist of 406 type-1 and type-2 diabetic patients. To collect data, the study used a questionnaire consisting of 32 items distributed as 20 items to assess the diabetic patients' knowledge, seven items to assess the diabetic patients' attitudes and 5 items to assess the diabetic patients' practices related to influenza vaccination. Data were analyzed using SPSS software. *Results:* A total of 406 diabetic patients were enrolled in this research. About 94.8% (n=385) of the patients reported that seasonal influenza is a viral infection, can spread from one person to another (96.3%), and 386 (95.1%) as main complications of seasonal influenza, respectively. The results revealed that participating diabetic patients had a good seasonal flu knowledge (70.9%, n=288), good vaccine knowledge (64.3%, n=261), and positive attitudes towards seasonal flu vaccination (65.7%, n=267). In addition, multivariate logistic regression showed that diabetic patients with DM duration of 6 to 10 years were 1.62 times more likely to be vaccinated compared to patients having DM for five years or less (OR: 1.62, CI: 1.13 – 3.27), diabetic patients who had DM for 11 to 15 years were 3.27 times more likely to get vaccinated *Conclusion:* The study concluded that diabetic patients attending diabetes outpatient clinics in KKUH have a good knowledge and positive attitudes towards seasonal flu and seasonal flu vaccination.

Keywords: Seasonal flu, vaccine, Diabetes, Knowledge, Attitudes, Practices.

1. INTRODUCTION

Diabetes Mellitus (DM) is a major health problem worldwide (Chentli et al., 2015). It is a number of metabolic disturbances that is characterized and identified by the presence of hyperglycemia in the absence of treatment (Yang et al., 2020). Diabetes is caused by absence of insulin secretion or non-functional insulin secretion, or both, orimbalance of carbohydrates, fats and proteins metabolism (Poznyak et al., 2020). Type 2 DM, formerly known as non-insulin-dependent, or adult-onset, results from the body's ineffective uses of insulin (Syarifuddin et al., 2019). Type 2 DM is more common and is ranging between 90% to 95% of individuals with DM globally, and is mainly resulting of excess body weight and lack of physical activities (Wu et al., 2014). According to the International Diabetes Federation (IDF), it was estimated that in 2019, 374 million of adults aged between 20 and 79 years were at increased risk of developing Type 2 DM, and the number is predicted to raise up to be 454 million by 2030 (Diabetes Federation International, 2017).

Diabetic patients, as other chronic diseases patients, could catch the influenza infection, which is a respiratory infection caused primarily by influenza A and Influenza B (Verger et al., 2018). Influenza is a seasonal epidemic with main symptoms that include fever, cough and muscle aches. Fever is a big distinguishing component between a cold and influenza (Nypaver et al., 2021). Some other common symptoms which may or may not be seen with a cold as well are headache, chills, loss of appetite, fatigue and sore throat (Scaramuzza et al., 2021). Like diabetes, influenza is a significant burden on the healthcare systems (Sellers et al., 2017). A significant issue and a significant big health concern happens every year is looking how we could mitigate and manage it and obviously take the burden off the health care system (Lee et al., 2014).

Diabetes and influenza obviously is a big problem that diabetics are at a high risk of complications, everything from hospitalizations to death, and generally a lot of it is they have multiple core movement conditions, maybe Chronic Obstructive Pulmonary Disease (COPD), hypertension, renal disease, all of which can be exacerbated by an influenza infection (Hulme et al., 2017). More recent literature reported that people with diabetes are at an increased risk of Ischemic events, such as heart attacks and strokes (Merkler et al., 2020). Diabetic patients who get an influenza infection for about seven days post the infection, they are at a six times increased risk of having a myocardial infarction or a stroke and it is thought to be because of an abrupt increase in inflammation (Gutiérrez-Spillari et al., 2020), ultimately leads to that increased risk of them potentially having a heart attack or a stroke (Fugate et al., 2014). In addition, some of the other reasons why people with diabetes are a little bit more at higher risks to develop influenza and having complications are because of the abnormal glucose metabolism (Goeijenbier et al., 2017). So, having diabetes seems to cause a bit of a dysfunction in terms of our white blood cells, so affects the ability of the WBCs to collect up and swallow foreign invaders.

Every year, the World Health Organization (WHO) release their recommendations for Influenza strains that tend to be more prevalent based on the geographical spot of the world (El Guerche-Séblain et al., 2019). However, increasing the diabetic patients' knowledge, awareness and practices related to Influenza vaccination remains the most effective action to mitigate and avoid the complications of Influenza infection (El Khoury & Salameh, 2015). Different studies have shown that there is a low level of knowledge, awareness and practice regarding influenza vaccination among diabetic patients around the world. For example, Olatunbosun et al., (2017) reported that poor knowledge and negative perceptions among diabetic patients in South Africa were the most significant obstacles of taking the seasonal flu vaccination. In addition, Sözen et al., (2021) indicated that lack of knowledge regarding the significance of influenza vaccine was the main barrier that prevents diabetic patients from getting the influenza vaccine. The study reported that providing diabetic patients with sufficient information had a significant positive effect on the vaccination rate.

In Saudi Arabia, Aljamili (2020) reported that despite the high level of knowledge regarding influenza vaccination, there is a low level of practices among the Saudi community members. In a more recent study by Sales et al., (2021), the findings of the study revealed that there is a very low rate of influenza vaccination among Saudi community members, which highlights the urgent need for a comprehensive awareness campaign targeting different categories of the community. Despite the availability of different studies that assessed the level of knowledge, awareness and practices related to influenza vaccination in Saudi Arabia, still there is a significant lack of studies that focuses on the diabetic patients' knowledge and awareness about influenza vaccination. Therefore, the present study aimed at assessing the knowledge, attitudes and practices of influenza vaccination among type 1 and type 2 diabetes patients in King Khalid University Hospital (KKUH) Riyadh, Saudi Arabia.

2. METHODOLOGY

Design of the study

The present study adopted the quantitative research through conducting a cross-sectional survey during the period between April 2021 and May 2021.

Study setting

This study was conducted in the diabetes center affiliated to the diabetes clinic in KKUH in Riyadh city, Saudi Arabia. The study was conducted in the period between June 2020 and June 2021.

Population of the study

The population of the current research was all type 1 and type 2 diabetic patients following up in the diabetes clinics in KKUH.

Sampling and sample size

The sample size was calculated using Raosoft. We calculated the sample size using the single proportion sample size formulae, where precision is 5%, confidence interval equal to 95%, and we assumed that the patients' percentage within influenza vaccination coverage is 61% among patients with diabetes. 360 participants was the minimum number of participants to be recruited in the present study. The final sample of the study was 406 diabetic patients.

Inclusion criteria were being type one or type two diabetic patients, older than 18 years, and can fluently read and/or understand Arabic. Patients who were less than 18 years and not confirmed through clinical diagnosis as type 1 or type 2 diabetic patients were excluded from this research.

Data collection measures

The study adopted the self-administered questionnaire as a data collection tool. The study adopted the questionnaire developed by Olatunbosun et al., (2017). The first part of the questionnaire was designed to elicit demographic characteristics of the study participants (gender, Age, Nationality, Social status, Educational level, Occupational status, Monthly income), and the clinical history data (Duration of diabetes diagnosis and Family history of Diabetes). The second part of the questionnaire included 32 items distributed as 20 items to assess the diabetic patients' knowledge, seven items to assess the diabetic patients' attitudes and 5 items to assess the diabetic patients' practices related to influenza vaccination.

The questionnaire had been ensured for validity and reliability in the Saudi context before administering over the study sample. The facial validity was ensured through submitting the questionnaire to a number of jury members from different Saudi universities. No amendments were recommended to the original version of the questionnaire. In addition, the construct validity was ensured through using Pearson's correlation coefficient. The value of Pearson correlation coefficient values ranged from 0.604 to 0.851, which revealed that the questionnaire is valid to be used in the Saudi context. To ensure the reliability of the questionnaire, the researchers carried out a pilot study over 30 diabetic patients who were excluded from the original study sample. The internal consistency reliability was calculated using Cronbach's Alpha coefficient. The value of Cronbach's Alpha coefficient was 0.738, which is acceptable value for the reliability. Therefore, the questionnaire was ensured for validity and reliability before using over the original study sample.

The researchers established a threshold score of the knowledge and attitudes scales. A knowledge score less than 65% was considered poor, whereas a score higher than 65% was considered as good knowledge. For the attitudes scale, a score equals or higher than 4 was considered as positive attitude, whereas a score equals to 3 or lower was considered as negative attitude. These cutoffs were calculated on the basis of the number of the correct responses from the total number of questions.

Ethical considerations

All participants have to sign the informed consent form. Respondents were not being able to fill in the survey unless they agree. The informed consent was clear and indicated the objective of the research, in addition, the participants were free to withdraw from the study at any time point they would like to do so without any further committment. No incentives or rewards will be given to participants. Finally, permission to use the data collection tool was obtained from the authors.

Data processing

The Statistical Package of Social Science (SPSS) (v. 25 IBM Corp) was adoptedfor the analysis of the data gathered in this study. Descriptive statistics were calculated to process the data related to the participants' demographic characteristics and their responses to the questionnaire items. In addition, independent samples t-test and one way Analysis of Variance (ANOVA) were used to identify the statistical differences in the diabetic patients' level of knowledge, attitudes and practices related to influenza vaccination. A significance value of $p \leq 0.05$ was used as a statistical significance threshold in this study.

3. RESULTS

The present study investigated the knowledge, attitudes, and practices of diabetic patients towards seasonal flu vaccination. The results presented in table (1) show the socio-demographic characteristics of the study participants. The average age score of the study participants was (50.96±14.59). About 68.7% (n=279) of the diabetic patients recruited in this study were males, whereas 31.3% (n=127) were females. In addition, the majority of the study participants (91.9%, n=373) were Saudi nationals.

Exploring the marital status of the study participants revealed that 79.6% (n=323) were married. In terms of educational level, the highest represented category were those having a university degree (undergraduate) who constituted 48% (n=195), whereas those who were illiterate were the least represented category, as they constituted 4.4% (n=18). In addition, categorizing the recruited diabetic patients based on their employment status revealed that retired patients constituted 33.5% (n=136), whereas private sector employees were constituting 27.3% (n=111). The least represented category were those who work as freelancers (5.2%, n=21).

The results related to the monthly income of the recruited diabetic patients revealed that 25.4% (n=103) of the diabetic patients had a monthly income between 5000 and 10 000 SAR, whereas 23.2% (n=94) had a monthly income of 15001 to 20 000 SAR. The least represented category were those who had a monthly income more than 20 000 SAR (11.8%, n=48). Distributing the patients based on the duration of DM indicated that 33.3% (n=135) had DM for less than 5 years, whereas 29.8% (n=121) and 25.6% (n=104) had DM for more than 15 years and from 6 to 10 years, respectively. Finally, the majority of the study participants (76.8%, n=312) reported that they had diabetes family history.

As shown in table (2), about 94.8% (n=385) of the participating diabetic patients reported that seasonal flu is a viral infection, 96.3% (n=391) believed that seasonal flu can spread from one person to another, and 81% (n=329) reported that it is preventable. In addition, 73.2% (n=297) indicated that seasonal influenza is similar to common cold and 98% (n=398) reported that seasonal flu occurs at certain time of the year. The participants' responses to the seasonal flu symptoms and complications among diabetic patients indicated that 92.8% (n=377) believed that seasonal flu symptoms are worse among diabetic patients, whereas 95.8% (n=389) believed that seasonal flu cause serious complications among diabetic patients. The most reported seasonal flu symptoms were sneezing (99.3%, n=403), fever (98.8%, n=401), running nose (97.5%, n=396) and headache (96.6%, n=392). On the other hand, the most reported complications were high risk of hospitalization (97%, n=394) and poor glycemic control (95.1%, n=386).

Table 1 Socio-demographic characteristics of the study participants

Variable	M (SD)	F (%)
Age	50.96 (14.59)	
Gender		
Female		127 (31.3)
Male		279 (68.7)
Nationality		
Saudi		373 (91.9)
Non-Saudi		33 (8.1)
Marital Status		
Single		53 (13.1)
Married		323 (79.6)
Divorced		13 (3.2)
Widowed		17 (4.2)
Educational level		
Illiterate		18 (4.4)
Primary		33 (8.1)
Intermediate		35 (8.6)

Variable	M (SD)	F (%)
Secondary		88 (21.7)
University degree		195 (48)
Higher studies		37 (9.1)
Employment		
Public sector		111 (27.3)
Private sector		38 (9.4)
Retired		136 (33.5)
Housewife		52 (12.8)
Freelance		21 (5.2)
Unemployed		48 (11.8)
Monthly income		
Less than 5000 SAR		70 (17.2)
5000 – 10 000 SAR		103 (25.4)
10 001 – 15 000 SAR		91 (22.4)
15001 – 20 000 SAR		94 (23.2)
More than 20 000 SAR		48 (11.8)
Duration of diabetes		
0 – 5 years		135 (33.3)
6 – 10 years		104 (25.6)
11 – 15 years		46 (11.3)
More than 15 years		121 (29.8)
Presence of diabetes family history		
Yes		312 (76.8)
No		94 (23.2)

Table 2 Perceptions of seasonal influenza, symptoms and complications as perceived by the study participants (n= 406)

Item	F (%)
Seasonal Influenza	
Is caused by a viral infection	385 (94.8%)
Can spread from one person to another	391 (96.3%)
Is preventable	329 (81%)
Is the same as common cold	297 (73.2%)
Occurs at certain time of the year	398 (98%)
Symptoms are worse among diabetic patients	377 (92.8%)
Cause serious complications among diabetics	389 (95.8%)
Symptoms	
Running nose	396 (97.5%)
Sneezing	403 (99.3%)
Headache	392 (96.6%)
Sore throat	388 (95.6%)
Cough	373 (91.9%)
Vomiting	274 (67.5%)
Muscle ache	357 (87.9%)

Item	F (%)
Fever	401 (98.8%)
Diarrhea	379 (93.3%)
Abdominal pain	289 (71.2%)
Complications	
Poor glycemic control	386 (95.1%)
High risk of hospitalization	394 (97%)
Pneumonia	128 (31.5%)

The results shown in table (3) represent a comparison of the knowledge and attitudes towards seasonal flu between vaccinated and non-vaccinated diabetic patients. The results showed that there was significant difference in the responses of the vaccinated and non-vaccinated diabetic patients regarding the safety of the influenza vaccine, its capability of preventing flu, its side effects, its protection for only one flu season, its serious side effects and that it should not be taken, willingness to take it if effective, and recommending influenza vaccine to all diabetic patients. The results presented in tables (4-6) show that 70.9% (n=288) of the participating diabetic patients had good knowledge regarding seasonal flu, whereas good knowledge level about seasonal flu vaccine was identified among 64.3% (n=261) of the study participants. Moreover, about 65.7% (n=267) had positive attitudes towards seasonal flu vaccination.

Table 3 Knowledge and attitudes towards influenza vaccination on the basis of being vaccinated or not (n= 406)

item	No. (%)			P-value
	Total (n=406)	Vaccinated (n=214)	Non vaccinated (n=192)	
Influenza vaccine is safe	268 (66%)	179 (66.8%)	89 (33.2%)	0.000
Influenza vaccine prevents flu	274 (67.5%)	198 (72.3%)	76 (27.7%)	0.000
Influenza vaccine has side effects	251 (61.8%)	166 (60.6%)	85 (39.4%)	0.000
Influenza vaccine can protect for only one flu season	316 (77.8%)	191 (60.4%)	125 (39.6%)	0.000
Influenza vaccine can prevent serious complications among diabetics	213 (52.5%)	180 (84.5%)	33 (15.5%)	0.000
Influenza vaccine is important for diabetics and should be take yearly	381 (93.8%)	194 (50.9%)	187 (49.1%)	0.717
Disagrees that influenza vaccine has serious side effects and should not be taken	263 (64.8%)	181 (68.8%)	82 (31.2%)	0.000
Would take influenza vaccine to prevent if effective	188 (46.3%)	161 (85.6%)	27 (14.4%)	0.000
Would recommend influenza vaccine to all diabetic patients	304 (74.9%)	191 (62.8%)	113 (37.2%)	0.000

Table 4 Knowledge about seasonal flue among the study participants (n= 406)

Level of seasonal flu knowledge	N	%
Good seasonal flu knowledge	288	70.9%
Poor seasonal flu knowledge	118	29.1%

Table 5 Knowledge about seasonal flu vaccine among the study participants (n= 406)

Level of vaccine knowledge	N	%
Good vaccine knowledge	261	64.3%
Poor vaccine knowledge	145	35.7%

Table 6 The participants' scores of attitudes towards seasonal flu vaccination (n= 406)

Attitudes score	N	%
Positive attitudes	267	65.7%
Negative attitudes	139	34.3%

The results presented in table (7) showed that 59.1% (n=240) of the diabetic patients agree that influenza vaccination is important and should be taken annually, whereas only 48.3% (n=196) agreed that influenza vaccine prevent serious complications among diabetic patients, and only 5.7% (n=23) agreed that influenza vaccine has serious side effects and therefore must not be taken. Moreover, about 50.5% (n=205) of the study participants agreed that all diabetic patients should receive influenza vaccine, and 28.3% (n=115) agreed that flu is a mild illness and therefore vaccination is not necessary. Finally, about 35% (n=142) reported that they don't need the seasonal flu vaccine because they have life immunity against flu, and about 82.5% (n=335) showed willingness to take the seasonal flu vaccine if there is an effective one.

**Table 7** Attitudes of the study participants towards seasonal flu vaccination (n= 406)

Item	Agree N (%)	Disagree N (%)	Don't know N (%)
Influenza vaccination is important among diabetics and should be taken yearly	240 (59.1%)	44 (10.8%)	122 (30%)
Influenza vaccine prevent serious complication among diabetics	196 (48.3%)	55 (13.5%)	155 (38.2%)
Influenza vaccine has serious side effect and therefore should not be taken	23 (5.7%)	274 (67.5%)	109 (26.8%)
All diabetics should receive influenza vaccine	205 (50.5%)	84 (20.7%)	117 (28.8%)
Flu is a mild illness and therefore vaccination is not necessary	115 (28.3%)	216 (53.2%)	75 (18.5%)
I don't need the flu vaccine because I have life immunity against flu	142 (35%)	180 (44.3%)	84 (20.7%)
If there is an effective vaccine to prevent flu, I will take it	335 (82.5%)	35 (8.5%)	36 (8.9%)

Exploring the factors influenced the vaccinated diabetic patients to receive the seasonal flu vaccination revealed that getting advice from their physician about the vaccine's importance was ranked first (55.6%, n=119), followed by other reasons (37.8%, n=81), recommendation from fellow patients about its effectiveness (21.5%, n=46) was ranked third, and lastly was the availability of free vaccines (17.3%, n=37) and public campaigns (6.5%, n=14) (Table 8).

On the other hand, exploring the reasons for not taking the seasonal flu vaccine by the diabetic patients revealed that the most reported reason is that the seasonal flu vaccine is not necessary because flu is just a minor illness (59.4%, n=114), followed by having alternative protection (354%, n=68), fear of needles and injections (15.6%, n=30), whereas the lowest reported reasons were that the vaccine is expensive (5.2%, n=10) and that the vaccine is not effective (12%, n=23) (Figure 1).

Table 8 Factors influencing previous influenza vaccination among diabetic patients (n= 214)

Factor	F (%)
Advice from the doctor that it is important	119 (55.6%)
Being told by fellow patients that it is effective	46 (21.5%)
Vaccine made available free of charge	37 (17.3%)
Public awareness campaign	14 (6.5%)
Other	81 (37.8%)

Figure (1). Reasons for not being vaccinated or not taking the seasonal flu vaccine (n= 192)
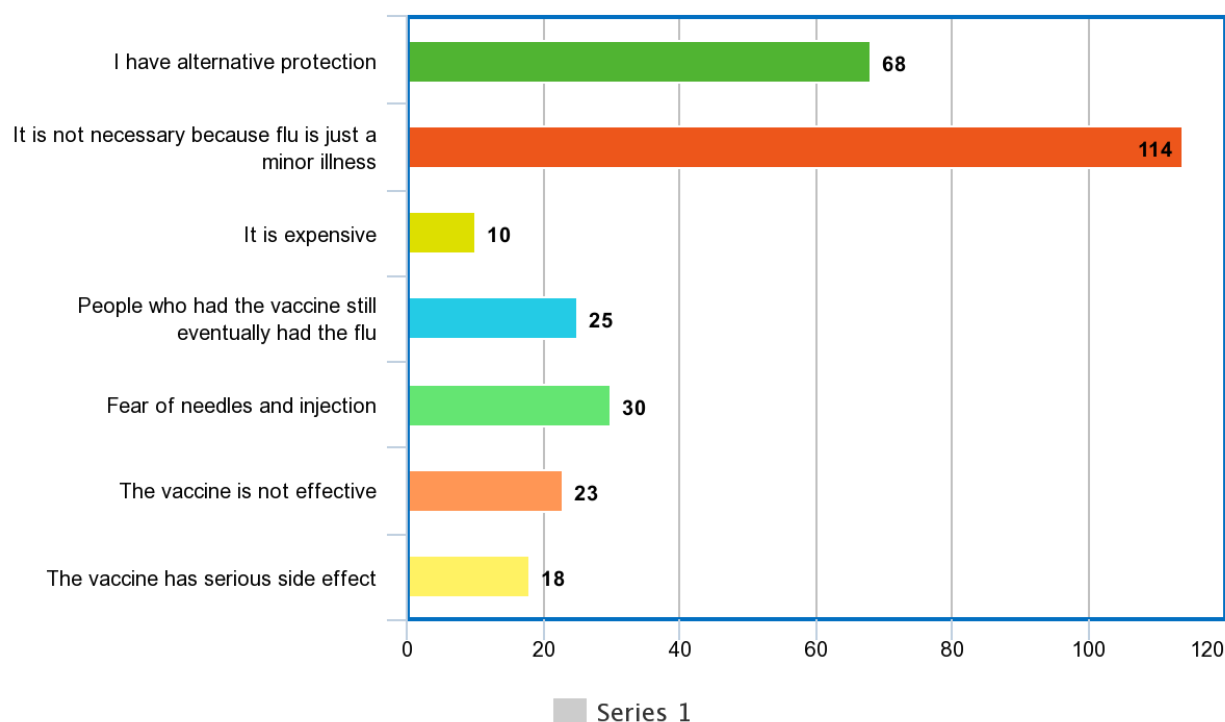
The results shown in table (9) represent multivariate logistic regression analysis after adjusting the model. The results revealed that age was not a significant predictor of seasonal flu vaccination among the participating diabetic patients. However, diabetic patients with DM duration of 6 to 10 years were 1.62 times more likely to be vaccinated compared to patients having DM for five years or less (OR: 1.62, CI: 1.13 – 3.27), diabetic patients who had DM for 11 to 15 years were 3.27 times more likely to get vaccinated compared to patients having DM for five years or less (OR: 3.27, CI: 1.55 – 6.74), patients who had DM for 15 to 20 years and more than 20 years were 4.21 and 3.55 times more likely to be vaccinated compared to patients having DM for five years or less (OR: 4.21, CI: 1.93 – 8.46) and (OR: 3.55, CI: 2.60 – 7.35), respectively.

Table 9 Potential factors influencing taking seasonal flu vaccination among diabetic patients (n= 214)

Variable	Previously ever vaccinated		
	Adjusted OR	95% CI	p-value
Age (less than 30)			
31 – 40	0.61 (0.39 – 0.88)		0.316
41 – 50	0.81 (0.54 – 0.96)		0.140
More than 50	0.14 (0.06 – 0.48)		0.091
Diabetes duration (5 years or less)	1.62 (1.13 – 3.27)		0.000
6 – 10 years	3.27 (1.55 – 6.74)		0.000
11-15 years	4.21 (1.93 – 8.46)		0.000
16 – 20 years	3.55 (2.60 – 7.35)		0.000

Variable	Previously ever vaccinated		
	Adjusted OR	95% CI	p-value
Age (less than 30) 31 – 40 41 – 50 More than 50	0.61 (0.39 – 0.88) 0.81 (0.54 – 0.96) 0.14 (0.06 – 0.48)		0.316 0.140 0.091
More than 20 years			
Attitude score (good Vs poor)	9.31 (3.67 – 11.42)		0.000
Knowledge score (total)	6.33 (4.08 – 8.41)		0.000

4. DISCUSSION

The present study aimed at assessing the level of knowledge, attitudes and practices of diabetic patients attending diabetic outpatient clinics at KKUH towards seasonal influenza and vaccination. The outcome of this research showed that a high majority of the participating diabetic patients were aware of the details about this infection as the majority of them reported that it is a viral infection, which could be transmitted from one person to another and could be prevented. In addition, a great majority of the participating diabetic patients showed good knowledge regarding the difference in severity of seasonal flu between diabetic and diabetic individuals, which is evidenced by reporting that seasonal flu symptoms and complications might be more serious among diabetic patients.

Moreover, the outcome of this research showed that the great majority of the participating diabetic patients were able to identify the symptoms and complications of seasonal flu (Running nose, sneezing, headache, sore throat and cough, in addition to other symptoms such as fever and muscle ache. The results also showed a good identification of seasonal flu complications, such as poor glycemic control and increased risk of hospitalization. These results are consistent with the findings of Olatunbosun et al., (2017) who found that South African diabetic patients were able to identify the symptoms and complications of seasonal flu. Investigating the participants' perceptions towards seasonal flu vaccination showed significant differences between vaccinated and non-vaccinated diabetic patients' perceptions regarding the safety, effectiveness and side effects of the seasonal flu vaccine. Previously vaccinated diabetic patients had more positive perceptions towards seasonal flu vaccination compared to non-vaccinated vaccines.

The outcome of this cross-sectional study revealed that about two thirds of the diabetic patients attending KKUH diabetes outpatient clinics had a good level knowledge about seasonal flu and its vaccination. In addition, a similar proportion had positive attitudes towards seasonal flu vaccination. These findings might be referred to the extensive awareness campaigns carried out by the Saudi Ministry of Health (MOH), such as the campaign of (Lets make it a healthy season), which was launched in February 2021 and targeted both citizens and residents of the groups most affected by the complications of the COVID-19, and the general public, stressing that all vaccinations are available in health centers. The campaign ensured that vaccination is safe, free, has no side effects, and has proven its efficacy for many years in all countries of the world, pointing out that influenza vaccination seasonality does not prevent infection with the emerging corona virus, but rather reduces the possibility of infection by a large percentage (Ministry of Health, 2021).

The results of the present study are similar to the findings of Abu-Rish et al., (2016) who found that Jordanian adults have a good level of knowledge about seasonal flu and vaccination. However, the context of the two studies is different as our study focused on adult diabetic patients. On the other hand, the results of the present study are inconsistent with the findings reported by Olatunbosun et al., (2017) who found that South African diabetic patients had low level of knowledge regarding the seasonal flu and seasonal influenza vaccination. Furthermore, this high level of knowledge regarding seasonal flu and positive attitudes among diabetic patients towards seasonal flu vaccination might be referred to the activation of different communication channels to increase the diabetic patients' knowledge and awareness regarding seasonal flu vaccination. This is evidenced by the results indicated that physician's advice, fellow patient's advice, public awareness campaigns and other methods were the influencing factors that motivated the diabetic patients to take the seasonal flu vaccine.

This result could be referred to the different means used in spreading the knowledge about seasonal flu and vaccination efficacy among the public, as the MOH in Saudi Arabia uses paper-based means such as brochures and flyers, social media platforms, word of mouth by healthcare providers and many other means to increase the public awareness regarding seasonal flu vaccination. Another explanation for the high level of knowledge and positive attitudes towards seasonal flu vaccination among the diabetic patients is that a high majority of the study participants are holding university degree, which indicates that they are educated and

this could significantly affects their knowledge and awareness due to their ability to search for information and use reliable sources to get information about seasonal flu and its vaccination.

On the other hand, those who were not vaccinated justified that by having alternative protection or considering flu as a mild illness or considering that the vaccine is not effective and not safe. This results highlights that there is still a need to increase the public awareness and knowledge about seasonal flu. In addition, this result might be attributed to the absence of national tracking strategy to the seasonal flu vaccination process among the diabetic patients. Finally, it was found that higher duration of diabetes is significantly associated with the likelihood of taking the seasonal flu vaccine. This result might be referred to patients' self-care behaviors that require them to avoid any exacerbation of the diabetic symptoms, which motivates them to take the vaccine, in addition to the recommendations from the healthcare providers in the diabetic outpatient clinics to take the vaccine to avoid any worsening in the health status. Moreover, it was found that both attitudes and knowledge are significantly associated with increased likelihood of taking the seasonal vaccine, which could be referred to patients' realizing of the benefits of the seasonal flu vaccine and its effect in reducing the complications that might happen among diabetic patients.

A major strength of this study is the scarcity of the local studies in Saudi Arabia that examine the knowledge, attitudes and practices towards seasonal flu and vaccination among diabetic patients. However, there is still a number of limitations of this study, such as the geographical limitation as this study was conducted in Riyadh city at the outpatient diabetic clinics in King Khalid University Hospital (KKUH). In addition, the study did not take in consideration the availability of the seasonal flu vaccination in the studied settings, which might affected the chance of vaccinating of non-vaccinated diabetic patients. Based on the outcome of this research study, the study recommends activating the role of the healthcare providers in increasing the diabetic patients' knowledge and awareness about seasonal flu vaccination and its effectiveness in reducing the flu symptoms and complications among diabetic patients. Moreover, this study recommends establishing a national tracking register to follow up the vaccinated diabetic patients and keep tracking the unvaccinated patients.

5. CONCLUSION

The study concluded that Saudi diabetic patients attending the diabetes outpatient clinics at King Khalid University Hospital (KKUH) have an adequate level of knowledge and positive attitudes towards seasonal flu vaccination. Diabetic patients are at higher risk of symptoms and complications exacerbation. Healthcare providers are considered a significant source of information related to seasonal flu and vaccination against seasonal influenza. The study stressed the significance of activating the role of the healthcare providers and public health agencies in increasing the knowledge and awareness regarding the seasonal flu vaccination effectiveness.

Author Contribution

The authors would like to declare that all authors had contributed equally in the production of this manuscript. The authors equally formulated the research problem, research questions, literature review, methodology and data collection and analysis.

Ethical Approval

This study was approved by the Institutional Review Board (IRB) at King Saud University (Ref. No. 19/0752/IRB, date 26/05/2019).

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This study has not received any external funding.

Conflict of Interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are presented in the paper.

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